Fixing the City One Photo at a Time: Mobile Logging of Maintenance Requests

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ABSTRACT
We have designed a mobile application that takes advantage of the built-in features of smart phones such as camera and GPS that allow users to take geo-tagged photos while on the move. Urban residents can take pictures of broken street furniture and public property requiring repair, attach a brief description, and submit the information as a maintenance request to the local government organisation of their city. This paper discusses the design approach that led to the application, highlights a built-in mechanism to elicit user feedback, and evaluates the progress to date with user feedback and log statistics. It concludes with an outlook highlighting user requested features and our own design aspirations for moving from a reporting tool to a civic engagement tool.

Author Keywords
Urban informatics, civic engagement, city maintenance, mobile applications, human-computer interaction, mobile interaction design

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
As both technology devices and technological practice evolve in turn, Human-Computer Interaction (HCI) continues to expand its focus from the design and assessment of particular interaction styles to encompass the role that interactive systems play in connecting people with their world. The focus of HCI is no longer grounded by the notion of the stationary user moored to a fixed PC in an organisational or domestic context. Rather, the user is 'everyware' [2] that is, constructed as fluid and mobile interacting with a diverse range of technologies across a broad range of platforms and contexts. Considering that the majority of the world's population is now living in cities [6], urban environments are one of these contexts that are increasingly significant for the design of both mobile and situated interactions between city dwellers.

We have embarked on a three year research project in Australia to explore the affordances of urban informatics, social media, ubiquitous computing, and mobile technology for the purpose of giving citizens new ways to have a voice and be heard, participating in urban planning decision making when and where it is convenient and relevant, and engaging in a decentralised, ad hoc and peer approach towards civic engagement [5].

Our research and design practice is not only informed by the study of new interaction modalities across different contexts, but also by partnering with a local government entity. This research collaboration enables us to consider opportunities and challenges from the perspective of both the urban resident as well as the administrative organisation that governs many parts of the vital infrastructure network of the city. In conversations with our partner we started to explore the possibilities that mobile technology affords and that the local government organisation was keen to exploit for the benefit of city residents. The local government website already featured various means to report city maintenance problems such as litter, graffiti, broken play equipment, damaged street signs, potholes, overgrown foliage, and blocked stormwater grates. City residents are able to call a dedicated phone hotline, submit a message electronically via a web form, or via a *fix-o-gram*, i.e. by taking a photo on their mobile phone and sending it via MMS to 0429 2 FIX IT with the location and a description of the problem. SMS messages are also accepted without a photo. The local government promises to acknowledge and investigate all submissions received. A reference number is issued within 48 hours to let users know that their request has been lodged. The main cause for concern, and for us the main opportunity to engage in a new interaction design research initiative with our partner, was the rising popularity of the Apple iPhone, and the fact that at the time in early 2009 the current version of the iOS did not support sending or receiving MMS texts. This excluded a large proportion of potential users from submitting maintenance requests, as well as from participating in the *Eyes in the Suburbs* promotion: Residents who report certain maintenance issues will automatically go in the draw to win one of ten $100 monthly cash prizes as part of this promotion. In April 2009 we proposed to 'fix' this situation as part of our ongoing collaboration by developing a native iOS application that allows city residents to easily take a photo of a maintenance related issue with the click of a button, automatically tag it with location data using the built-in GPS, and submit it on the spot to the local government. We acknowledge that this per se may not be that innovative from an academic or design point of view. However, it promised potential for our research project to do greater things later on. It would produce a simple smart phone application that we can

freely distribute via the iTunes app store to grow a base of local users. Through progressive version updates, we can introduce new features to an established user group as well as built-in response mechanisms to collect user feedback for research and evaluation, and be "in everyone's pocket."

This paper reports on our experience to date of developing and deploying a purpose-built smart phone application for the mobile logging of city maintenance requests. We first review related works. Our choice of approach to design and evaluation is guided by the collaborative arrangement with our partner organisation as well as the mobile context of use for the interaction. This is followed by a discussion and analysis of our research data to date. We conclude with a summary of new features proposed by users that we will implement into the next version.

REVIEW OF RELATED WORKS

One of the first applications that acknowledged the opportunities from crowd-sourcing maintenance requests, originated in the UK: FixMyStreet.com. It is an application provided by mySociety, an e-democracy project aiming to build "socially focused tools with offline impact." To date, FixMyStreet is available as a web application tailored for desktop use only, but third-parties have implemented mobile apps for iPhone, Android and Nokia phones. It is being used throughout the UK, allowing residents to enter a postcode, locating the problem on a map and entering the details of the problem, which are then forwarded to local governments. It attracts over 1000 reports per week and has since also been adopted in Canada through the Visible Government non-profit, as well as other countries such as New Zealand and Korea. In its mission to provide quick and easy access to all New York City government services and information, the NYC local government launched the 311 phone hotline in 2003. It gave residents a channel to report all non-emergency issues around the city. Seven years after its launch, the 100 millionth call had been received (see http://bit.ly/9YaVAD), and has since been implemented in other cities around the U.S. The popularity and success of this initiative demonstrates the real need for residents for such an easy access point, especially since running a call centre that can cope with the sheer volume is expensive. At least some of the volume can be reduced by allowing residents to use a mechanism that directly enters their request into the backend database, cutting out mediators, and opening up the data so that the public is aware of already submitted requests and can exchange information around local issues. The openness might not only reduce the amount of duplication and repetition, but also lead to the issue being resolved without the local government getting involved. The Open311 initiative aims at facilitating an international effort to build such open and inter-operable systems. It provides a standardised technology for location-based collaborative issue tracking by suggesting an open model and offering a free web API. A long list of apps for issue reporting have since been developed adopting the Open311 model (http://wiki.open311.org), but only two are available in Australia: NeatStreets (http://neatstreets.com.au/) and the internationally available SeeClickFix. Both apps require the user to register and login before submitting requests. Further, both apps make other residents' requests visible and allow users to comment on them, too. However, the strategies for bringing those issues to the attention of the local government differ: In NeatStreets, the administrators participate in the commenting to clarify any reports which may not have included enough detail. The report is then emailed to the local authority, and any email responses from the local authority regarding this issue are published as part of the comment trail. SeeClickFix allows local authorities to subscribe to their city area, which then triggers notifications being sent to them every time a resident reports an issue. NeatStreets' approach will not scale well as more users start using the application. Further, it is less than ideal that a structured entry is sent as an email, which then has to be parsed again to be entered into a CMS. This is also the limitation of the similar SnapSendSolve. SeeClickFix's approach is automated and reduces overhead, however, it requires the local authorities to interface with their service, which to date is still lacking in Australia.

The three main points of distinction of our design are an open interface without a need for user registrations, the local customisation, and the tight integration with the backend system of the local government. Asking whether an email solution would be more palatable to their needs, they responded, "*while there is some re-entering done after we receive the request, we absolutely do not want to receive the requests as e-mails. The way the app works now is perfect for our needs, as the requests are auto-entered into one of our tracking systems*."

APPROACH

Everyday technology becomes more and more ubiquitous: small, embedded and accessible anywhere, anytime [2]. Bell & Dourish [1] argue that the design and development of ubiquitous computing as well as the ability to access information in places other than the conventional desktop PC, call for a better appreciation of the 'messiness of everyday life,' which ultimately requires social and cultural research skills in addition to technical and design expertise. Therefore, rather than trying to conduct a controlled and staged research and design project informed by theory, we decided engage in a rapid prototyping process [3] that conducted multiple layers of data collection in parallel. It involved the creation of basic specifications based on our review of related and similar applications available at the beginning of the study, an analysis of the requirements of our partner organisation through stakeholder interviews, and early, small-scale user studies. We also implemented a mechanism to elicit feedback and comments from mobile users during use [4], built into the application. Selected data that was gathered through this strategy is being presented further below. Early 2009 we started discussions with staff of the local government authority responsible for the *fix-o-gram* program, and our initiative was met with enthusiasm and strong support at that level.

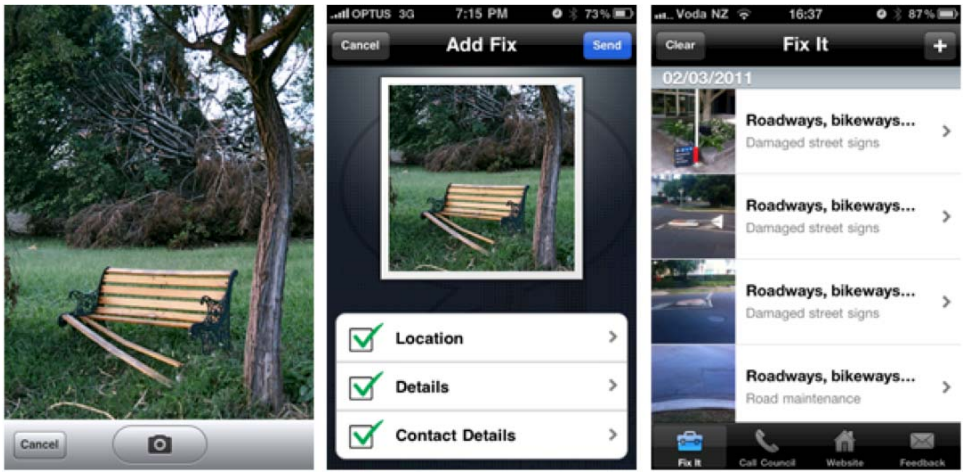

Figure 1. a) The first step is to take a photo of the issue that requires maintenance. b) Green ticks indicate progress. c) Overview of submitted requests on the home screen.

However, since our project wa s seen as desirable but not essential, competing demands caused delays. These hurdles were overcome and specifications, discussed in the design section, were drafted to inform the programming and developmen t phase mid 2009. Early prototypes were released as ad-hoc distributions locally to members of our research lab, other university colleagues, as well as 15+ staff of our partner organisation who agreed to be test users. T hese usability tests ironed out bugs that only became apparent on different iOS versions and different contexts provide d by the diversity of users, local environments, and maintenance job types that users tried to submit. At this stage our goal was to adopt the branding of the partner organisation and submit job requests directly to the backend systems of the local government. Time was spent on trying to negotiate a formal contract and on additional developm ent and testing. M any issues to do w ith internal security features and the complexity of web java scripts emerged that for instance prevents data that is incorrectly form atted by the user from being parsed on the server side at all. W e eventually managed to work around these issues early 2010 by a mutual decision to release the app under the university branding and buffering user data on our server before passing it on to the local government by submitting data via their existing m aintenance request form on the web. Version 1 of the app was released in the app store and has been available as a free download since May 2010.

DESIGN

The interface design is m odelled on the steps required in order to submit a *fix-o-gram* on the Brisbane City Council website. First time users are presented with an empty mask in which an empty photo frame suggests the first step: “tap here to attach an im age of the issue.” Users can either take a photo or choose one from their album. As second step, the location is determined by one of three mechanisms. First, if the photo was taken with GPS coordinates, reverse geocoding is used to enter the next nearby street address automatically into the form. Second, users can also opt to “use current location” to trigger reverse geocoding of where th ey are at that moment. Failing that, users can enter or correct an address manually. In step 3, the app adopts the same set of service categories (footpaths; parks and gardens; roadways, bikeways and waterways; stor mwater drain maintenance) that the local government accepts on their online submission form including asso ciated sub -categories as well as a freestyle description field. It was clear that the pre-defined set of categories added a limitation in that there was no option to select a miscellaneous or ‘other’ category, but we did not have the option to modify the existing backend system that relied on the established set of categories. However, our ev aluation revealed that this limitation did not stop users from submitting any type of maintenance request anyway using a random category, and local government staff allocating it to the correct maintenance team nonetheless. The final part of the submission pertains to contact details that only have to be entered once and that can be copied from the internal address book. Upon subsequent use, the app remembers these settings in the future, but they can be changed. Figure 1a and Figure 1b illustrate these steps up until the final screen reveals three green ticks indicating that the maintenance request can be subm itted. In case of transmission issues or lack of internet access, a dialogue

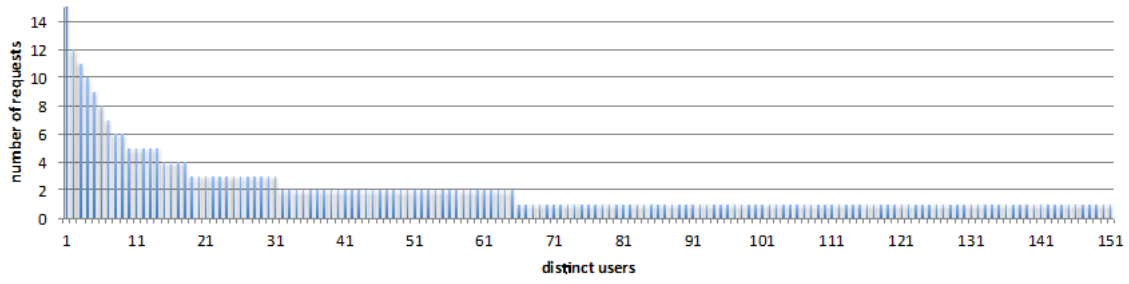

Figure 2. Number of requests per distinct user.

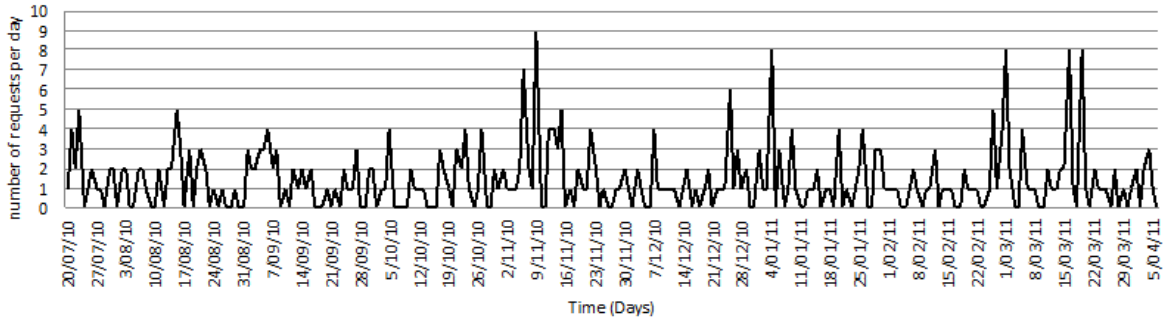

Figure 3. Number of requests per day.

box informs the user that the submission was not successful, the request is saved and can b e re-subm itted when network connectivity is re-established. The hom e screen (Figure 1c) show s a list of the user's subm itted maintenance requests. Tapping an entry displays the full details of each request. The home screen also contains buttons at the bottom to call the phone hotline of the local government, open their website, or send feedback to the research team. It is this fee dback feature that form s part of the collection strategy for our user data that we discuss further below.

EVALUATION

We have conducted small-scale user studies with lab members, other QUT volunteer s, as well as sixteen employees at the Brisbane City Council. Users were asked to submit feedback via email, or report to our liaison per son at BCC, who t hen passed f eedback on t o us. Additionally, the discussion below is based on data from our feedback feature, from statistics provided by the Apple app store, and from log data of our servers.

▼ Footpaths	94
Cleaning	25
Grass cutting	3
Maintenance	66
▼ Parks and gardens	64
Maintenance	45
Rubbish and graffiti	19
▼ Roadways, bikeways and waterways	212
Cleaning	30
Damaged street signs	57
Kerb and gutters	17
Road maintenance	108
▼ Stormwater drain m aintenance	8
Blocked stormwater grates	8
Grand Total	**378**

Table 1. Submissions by category.

Over the duration of this user study (M ay 2010 – April 2011), we received 378 requests by 151 distinct users (Figure 2). T he top user subm itted 75 requests, w hich is capped in the figure for better readability, and 30 users were regular users subm itting 3 or m ore requests. The nature of the requests is illustrated in T able 1. T he majority of all requests are located w ithin the inner -city suburbs and relate to road and foothpath maintenance, i.e. residents reporting potholes, br oken traffic lights, etc. Figure 3 illustrates the num ber of requests received per day since launch. It shows a consistent use of the app over time from the 151 users and demonstrates that residents are persistently providing Eyes in the Suburbs. The few peaks reaching 6+ requests per day are attributed to 'pow er users' subm itting a w hole list of requests at once.

CONCLUSION

The analysis of our user study has unveiled a num ber of useful feature requests that we are keen to implement in the next version of the app. Some of them include: a display of GPS accuracy to determine whether the reverse geocoded address is correct; iO S 4+ m ultitasking; lookup of postcodes; collective aw areness of requests subm itted; and tracking the status of repairs. W e also received ideas for additional m aintenance categories handled by other entities, such as reporting faulty street lights, sm okey vehicles, and lost shopping tr olleys. Furthermore, we were pleased about expressions of interest from other agencies such as cam pus facilities m anagement, the State's railway operator, and other local governments.

Our own aspiration lies in transform ing the app from a mere maintenance reporting tool to a genuine civic engagement tool that also allows for the submission and discussion of non-maintenance requests, i.e. ideas to improve the city. We are looking into merging it with our engagement tool for urban screen interaction [5].

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